Treatment options of furcation involved teeth

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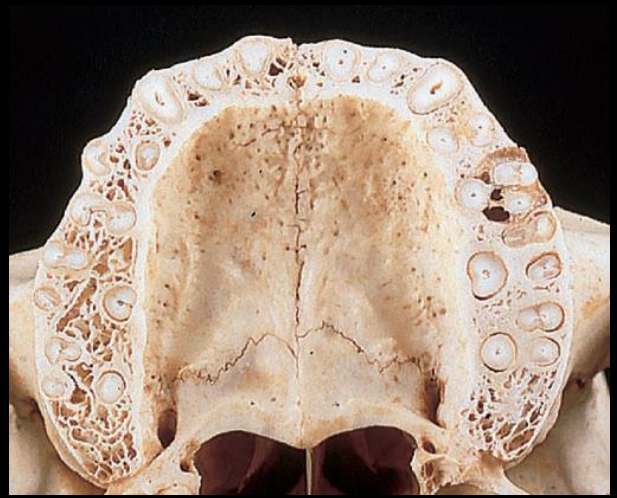
Dr. Nagy Pál

Parodontológiai Klinika

Introduction -Prevalence

- furcation (is the area located between individual root cones) = locus minoris resistentiae



- 16,26 are the most often affected, 3X more than lower molars
- The vestibular furcation is the most commonly affected followed by MP and DP
- first molars usually have shorter root trunks as second molars

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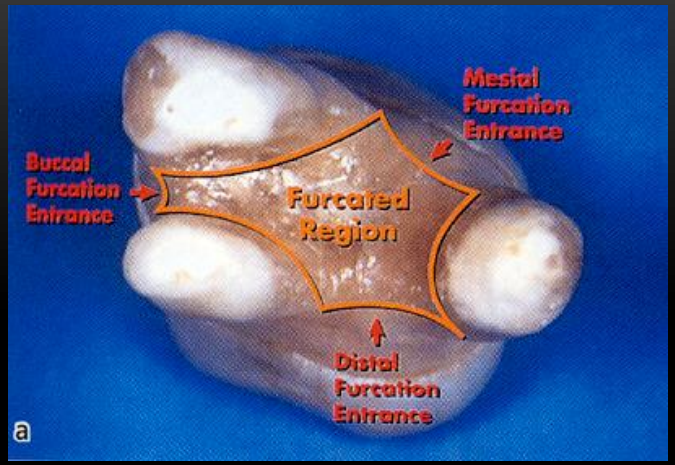
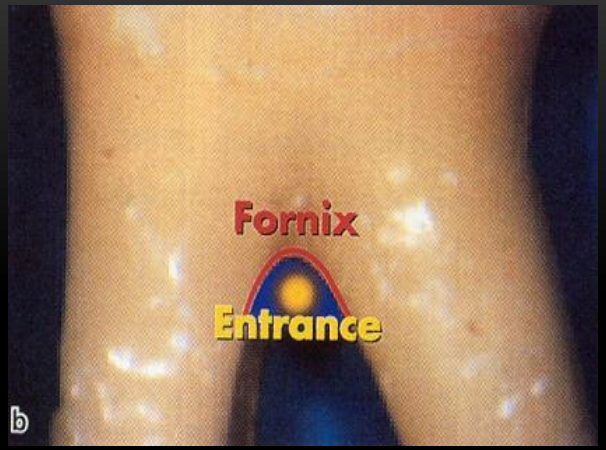
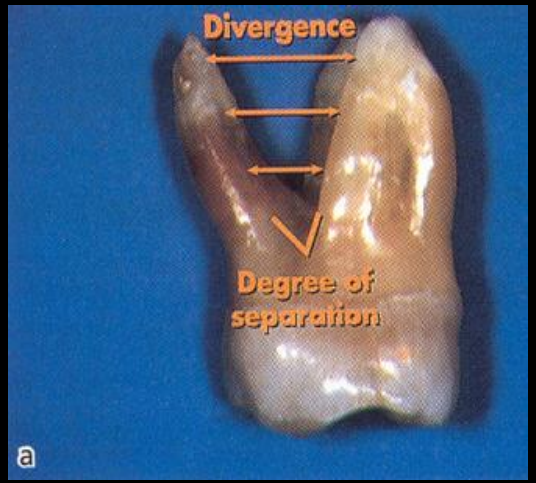
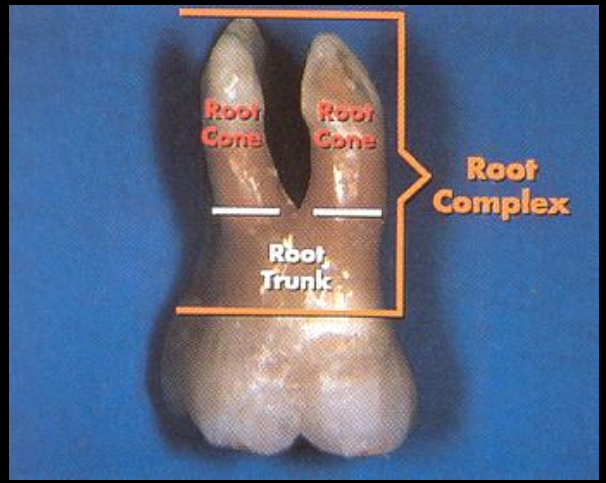

Mesial
Furcation
Entrance
Buccal
Furcation
Entrance
Furcated
Region
Distal
Furcation
Entrance
a


Fornix
Entrance
b


Divergence
Degree of
separation
a


Root
Cone
Root
Cone
Root
Complex
Root
Trunk

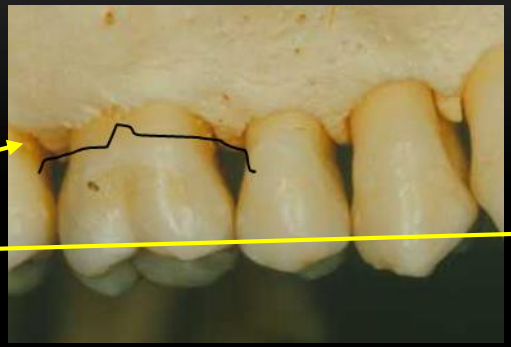
Etiology

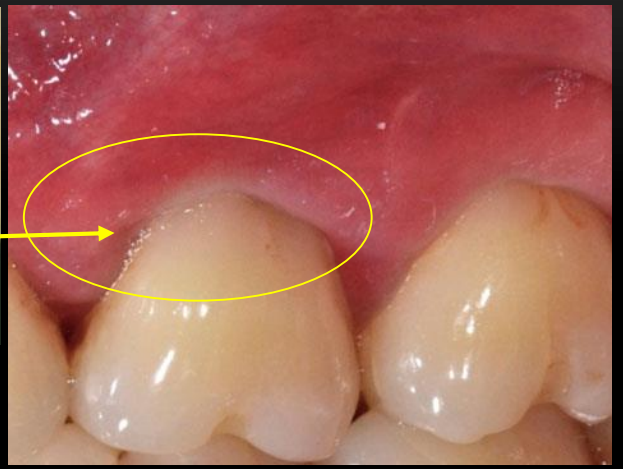
Prof. Dr. Windisch Péter

Etiology

Enamel pearls, enamel projections

- Enamel pearls and enamel projections are derived from Hertwig's epithelial root sheath under CEJ.





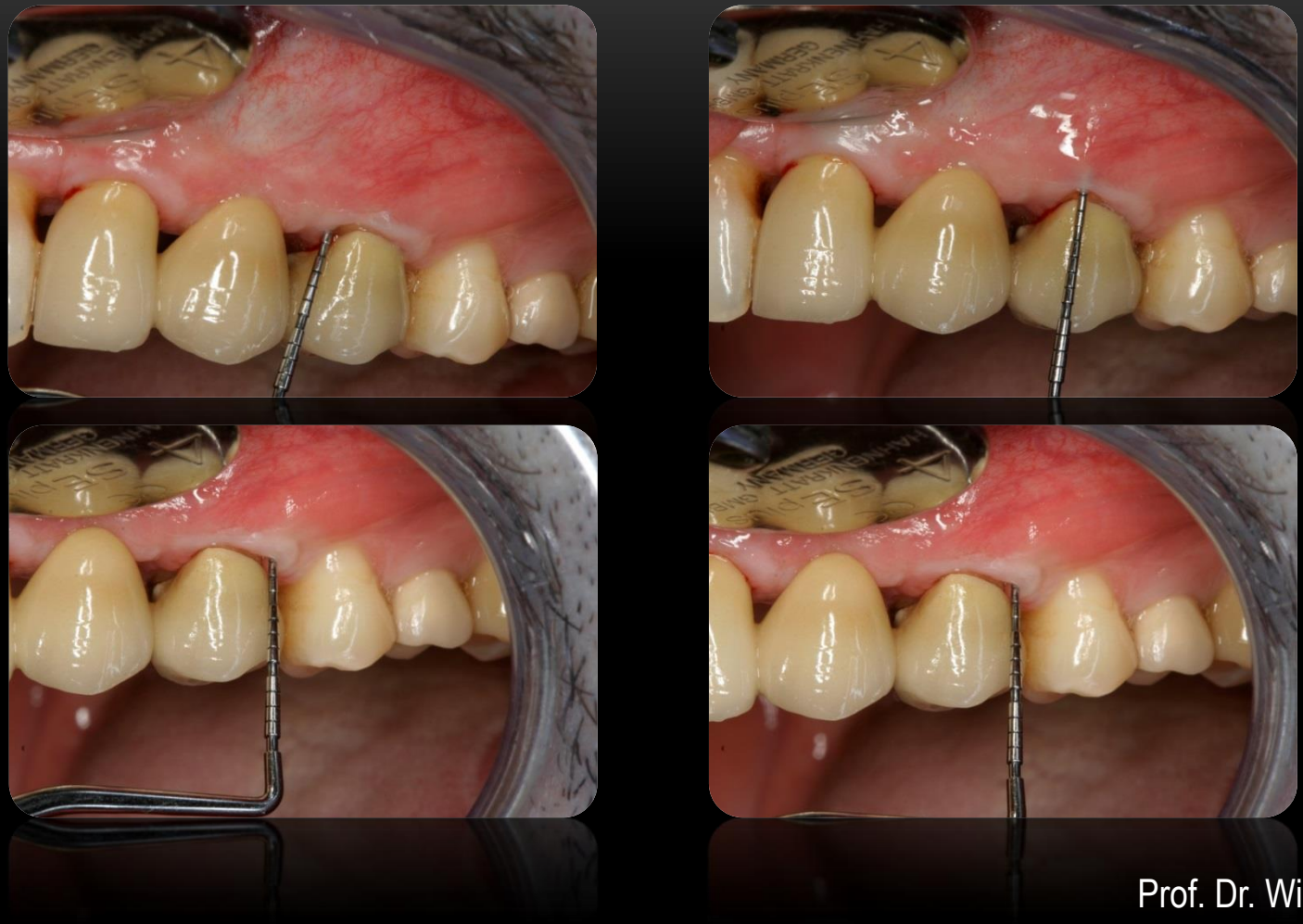
- Enamel projections: lack of connective tissue attachment

- Enamel pearls: occure in 1-10% especially at the furcation area of maxillary second and third molars. They are often isolated, containing enamel and dentin, in some of the cases they contain pulpal tissues as well.

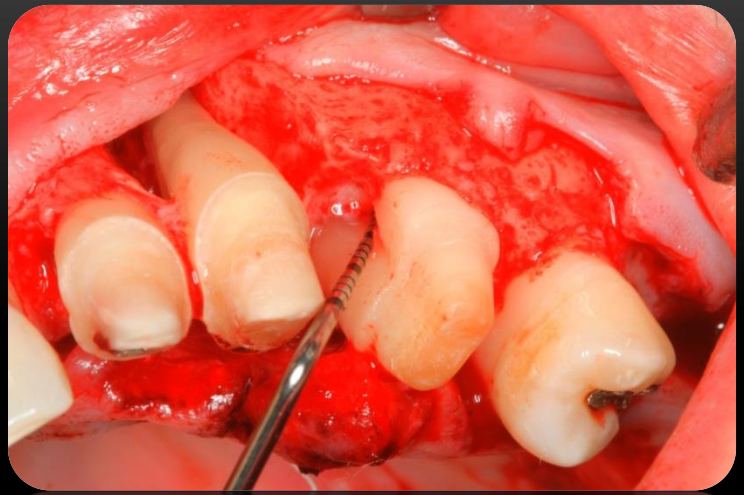
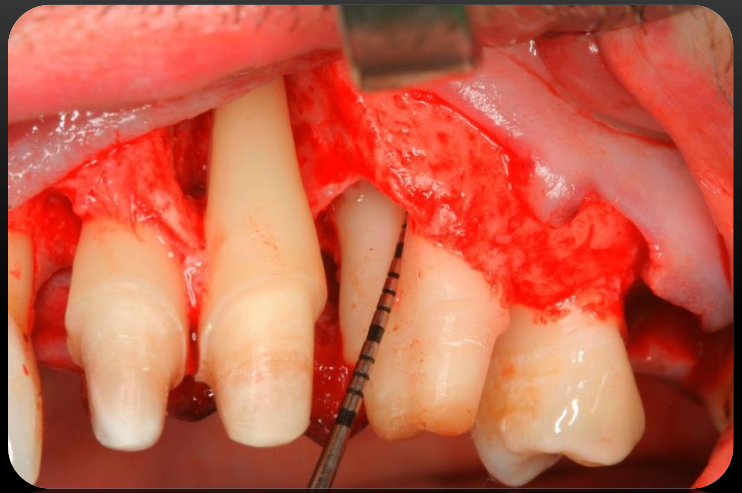
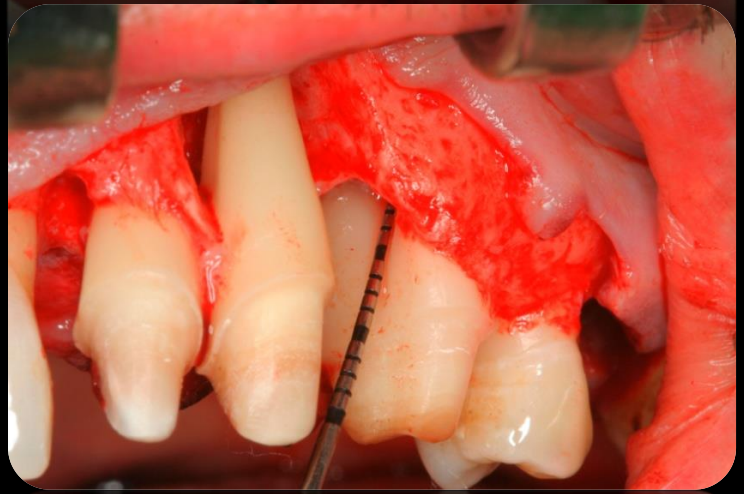
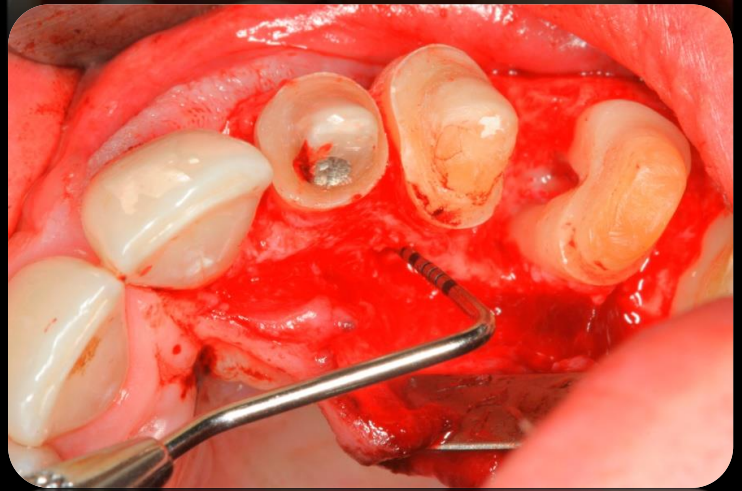
Sanz M, Jepsen K, Eickholz P, Jepsen S. Clinical concepts for regenerative therapy in furcations. Periodontol 2000. 2015: 68(1):308-32.

Maxillary praemolars

- in 40% of the cases maxillary first praemolars have 2 roots with furcation in mesiod-distal direction ➡ difficulties in cleaning
- In 78% of the cases concavity on buccal root
- furcation usally located in the middle or apical third of the root
- Pseudofurcation often occurs, that makes the diagnosis and periodontal treatment particularly difficult.
- Average distance between CEJ and furcation ~ 8 mm

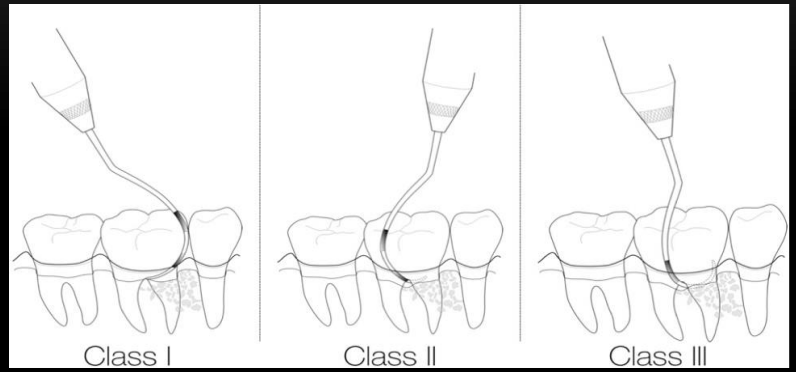


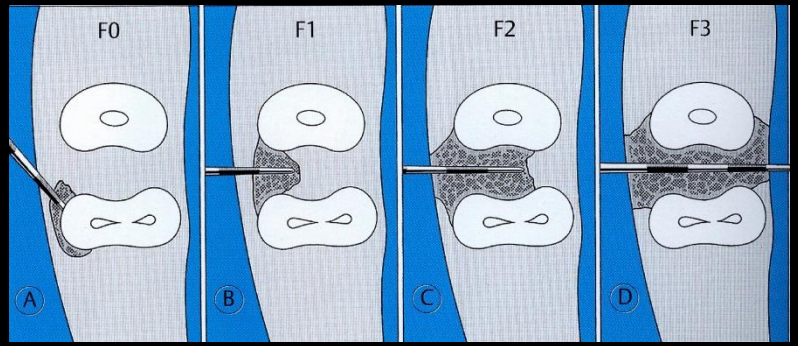
Prof. Dr. Windisch Péter

Classification of furcation defects I.

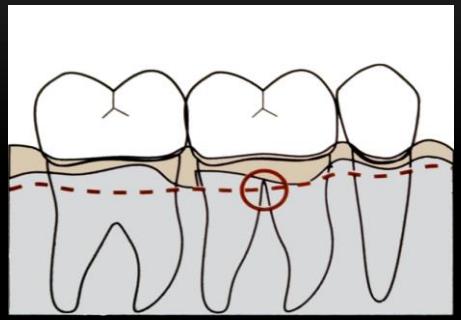
- with Nabers-probe - curved, colour-coded and is marked in millimeters
- based on horizontal penetration (Hamp et al, 1975)
- Degree 0: the area of furcation is not accessible
- Degree I: horizontal loss of periodontal support not exceeding one third of the width of the tooth (or 3 mm)
- Degree II: horizontal loss of periodontal support exceeding one third of the width of the tooth (3 mm), but not encompassing the total width of the furcation
- Degree III:horizontal "through-and-through"destruction of the periodontal tissues in the furcation area





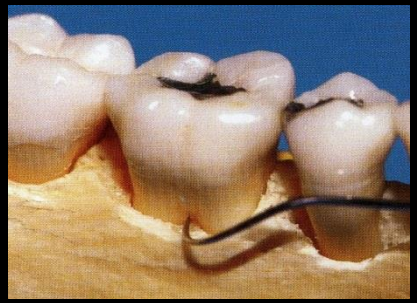
Hamp SE, Nyman S, Lindhe J. Periodontal treatment of multirooted teeth. Results after 5 years. J Clin Periodontol 1975;2:126-135.

Classification of furcation defects

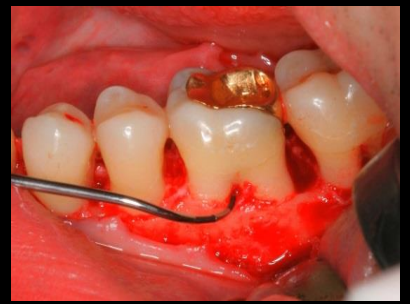


Nabers-probe

F0

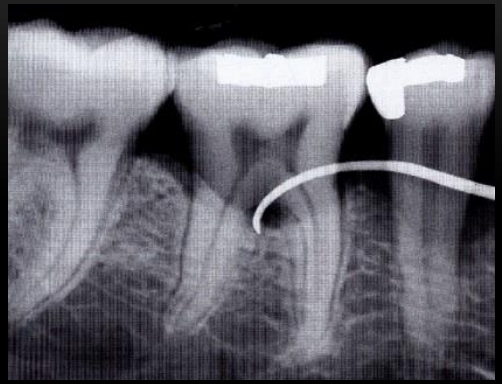


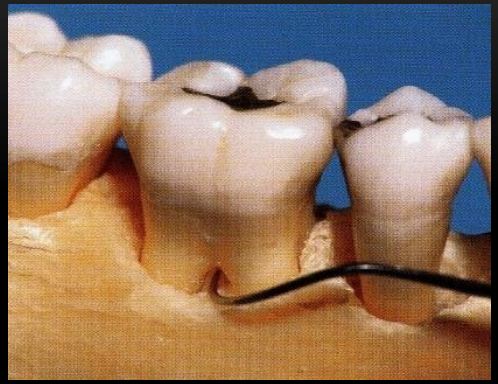
F1



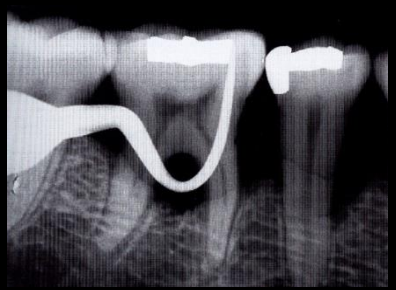
Classification of furcation defects

F2





F3



Classification of furcation defects II.

- **Based on horizontal and vertical bone loss** *(Tarnow et al. 1984)*
- between the roof of the furcation and the existing bone
- Considers the degree of both vertical and horizontal bone loss ➡ more effective in evaluating the prognosis
- A: 1-3 mm
- B: 4-6 mm
- C: 7 mm <

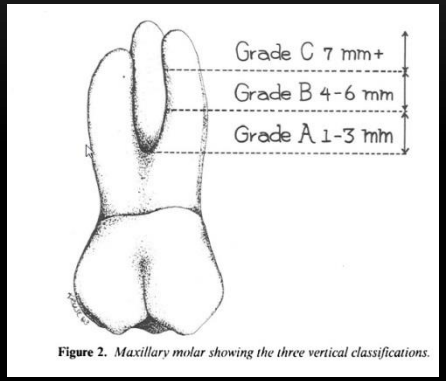


Figure 2. *Maxillary molar showing the three vertical classifications.*

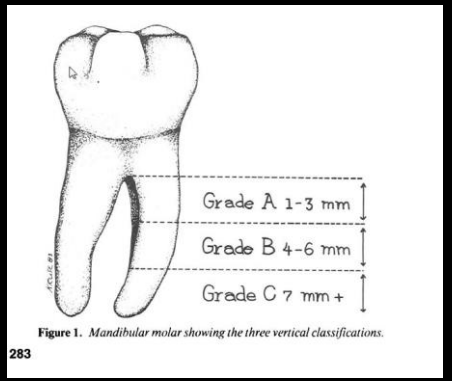


Figure 1. *Mandibular molar showing the three vertical classifications.*

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Tarnow D, Fletscher P. Classification of the vertical component of furcation involvement. J.Periodontol 1984;55:283

Classification of furcation defects II.

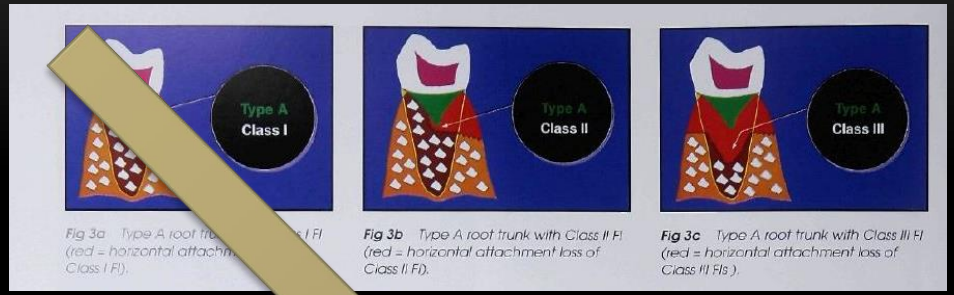


Fig 3a Type A root tru... I FI (red = horizontal attachm... Class I FI).

Fig 3b Type A root trunk with Class II FI (red = horizontal attachment loss of Class II FI).

Fig 3c Type A root trunk with Class III FI (red = horizontal attachment loss of Class III FIs).

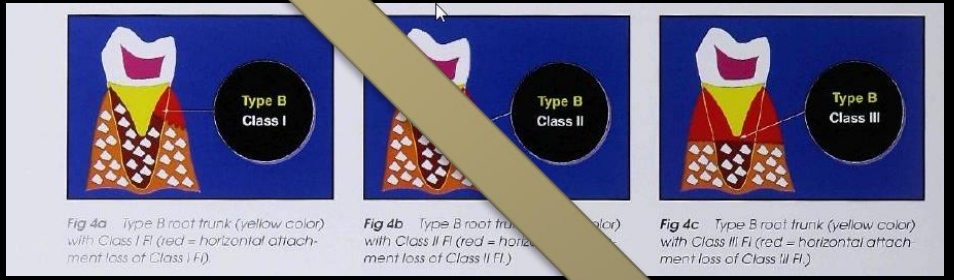


Fig 4a Type B root trunk (yellow color) with Class I FI (red = horizontal attachment loss of Class I FI).

Fig 4b Type B root tru... with Class II FI (red = horiz... ment loss of Class II FI.)

Fig 4c Type B root trunk (yellow color) with Class III Fi (red = horizontal attachment loss of Class III FI.)

Fig 5a Type C root trunk (orange color) with Class I FI (orange color = horizontal attachment loss of Class I FI).

Fig 5b Type C root trunk (orange color) with Class II FI (orange color = horizontal attachment loss of Class II FI).

Fig 5c Type C root tru... color) with Class III FI (orange ... zontal attachment loss of Class III FI).

PROGNOSIS

Wisdom tooth extraction in early age

- eruption of mandibular wisdom teeth often result in crowding of 1. and 2. mandibular molars

↓

- resulting in hyperocclusion in the curve of Spee (like a „spur wheel”)

↓

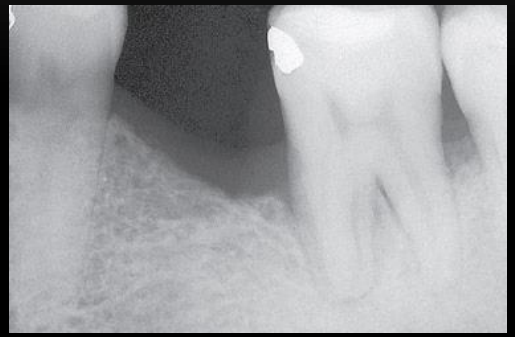
early extraction of lower 8 is beneficial

Factors influencing treatment outcomes

- Anatomical factors (supernumerary roots)
- Spreading of the defect
- Trauma from occlusion (differential diagnosis)!!
- Plaque retentive factors
- Number of affected furcations within the tooth and the quadrant
- Processes in pulp
- Anatomical variations (enamel pearls, enamel projections, supernumerary roots)
- Tooth mobility

Differential diagnosis -Trauma from occlusion

- could enhance susceptibility of periodontium to plaque-induced infection
- The tooth may exhibit increased mobility!!
- Occlusal adjustment must always precede periodontal therapy!
- If the defect has occlusal origin, following occlusal correction, the defect could disappear within weeks

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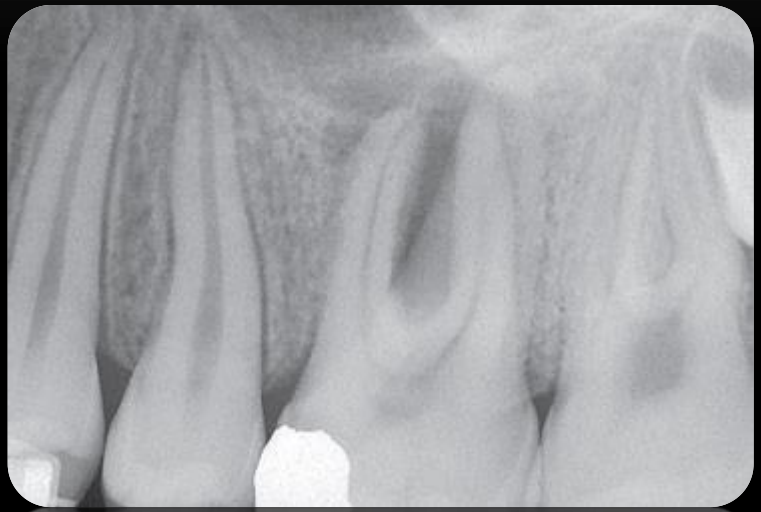
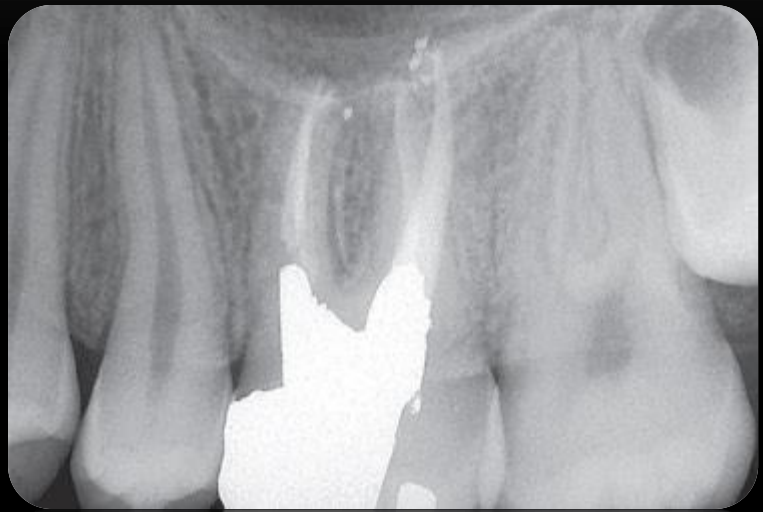
Differential diagnosis - Endo-periodontal lesion





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Treatment options of furcation lesions

Grade I

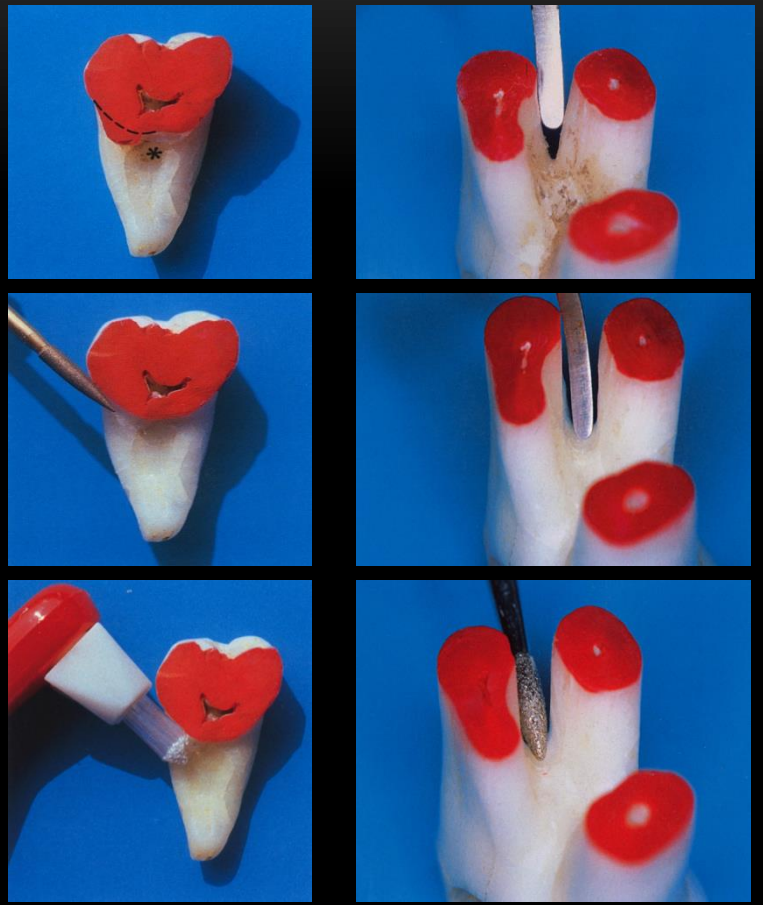
- Scaling, root planning
- Furcation plasty
- Regeneration?

Furcation plasty

Therapy

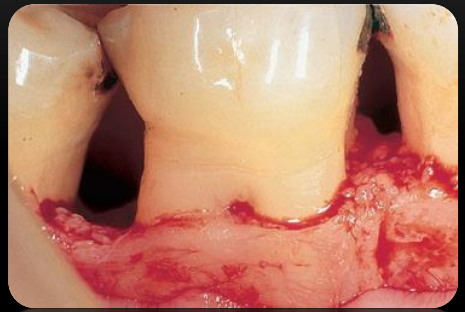
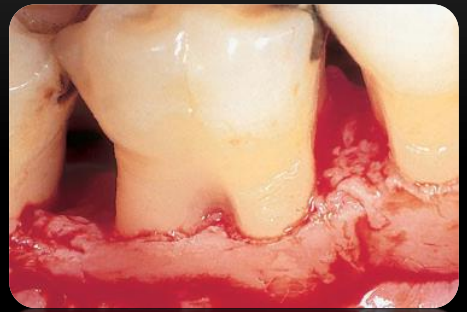
- 1. the dissection and elevation of a soft tissue flap – to obtain access
- 2. Scaling, root planning, the removal of the inflammatory soft tissue from the furcation area
- 3. Odontoplasty: the removal of crown and root substance in the furcational area to eliminate the horizontal component of the defect and to widen the furcation entrance.
- 4. Osteoplasty: the recontouring of the alveolar bone crest in order to reduce the buccal-lingual dimension of a bone defect
- 5. the positioning and the suturing of the mucosal flaps at the level of the alveolar crest in order to cover the furcation entrance

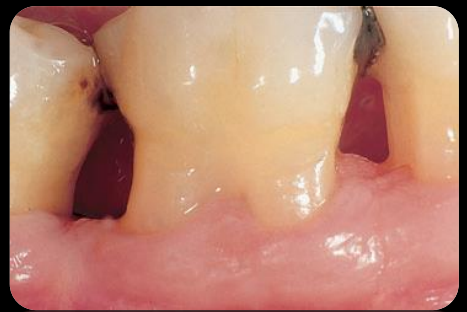
- Following healing a „papilla-like" tissue should close the entrance



Herbert F. Wolf, Klaus H. Rateitschak, Edith M. Rateitschak: Parodontologie: Farbatlanten der Zahnmedizin

Furcation plasty

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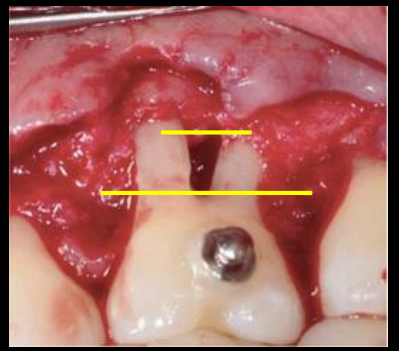
Treatment options of furcation lesions

Class II.

- (Furcation plasty)
- Regeneration (GTR, EMD, xenografts, PRP)
- Tunnel preparation
- Root separation and resection (RSR)
- Extraction

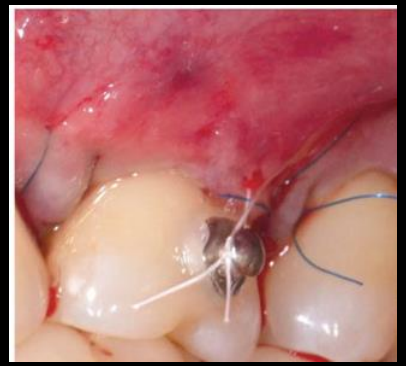
Regenerative strategies- Furcation lesions

- Furcation class I: complete regeneration is possible
- Furcation class II: can be converted to furcation class I.
- Furcation class III: histologically regeneration was not proven in human
- the lingual site is limited!



Regenerative strategies: combined therapy is suggested,
exc. EMD + GTR:

- EMD + Graft
- EMD + Graft + GTR
- rhPDGF + Graft

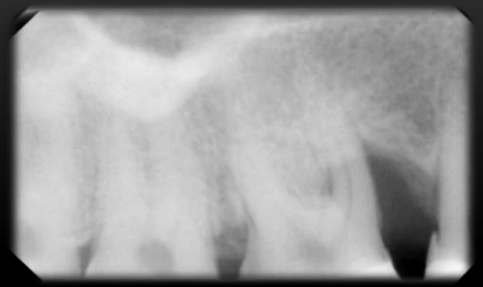


Jaiswal R, Deo V. Evaluation of the effectiveness of enamel matrix derivative, bone grafts, and membrane in the treatment of mandibular Class II furcation defects. Int J Periodontics Restorative Dent. 2013 Mar-Apr;33(2):e58-64.

Regeneration - EMD

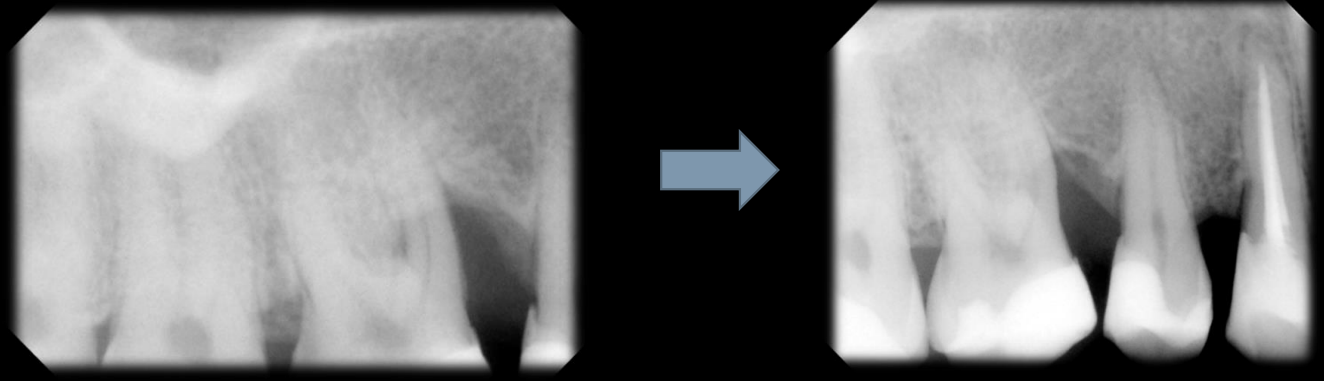
Enamel matrix proteins (Emdogain, Straumann, Basel, Switzerland) compared with GTR technique

- A multicenter randomized controlled clinical trial, with paired mandibular molars with buccal degree II furcation involvements (Jepsen et al. 2004):
- Mean reduction in the open horizontal furcation depth of 2,8 mm for EMD treated sites and of 1,8 mm for GTR-treated defects
- In addition the frequency of complete closed furcation defects was higher for EMD sites (8/45) than for GTR sites (3/45).
- It was concluded that both treatment modalities resulted in significant clinical improvements although the EMD method provided (1) greater reduction of the furcation depths, (2) a smaller incidence of post-operative pain/swelling, and (3) less gingival recession (Meyle et al. 2004) as compared toGTR therapy.



Dr. Csifó-Nagy Boróka

EMD, control x-ray 12 months later



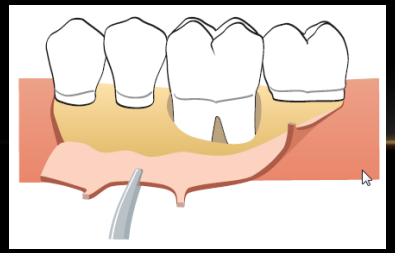
Regeneration - GTR technique

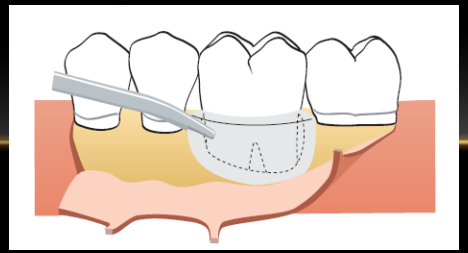
- using the barrier membranes prevents the apical migration of epithelium

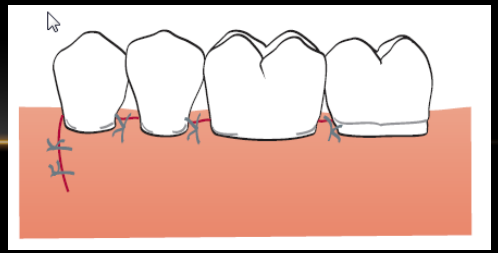
may allow (guide) periodontal ligament cells to repopulate the detached root surface (Gotlow et al. 1986).

- Technique sensitive procedure ➡ early exposure of the membrane and the fornix
- The predictability of this treatment outcome improves following GTR therapy if

the *interproximal* bone is located at a level which is close to the CEJ of the approximal surface („key-hole type")

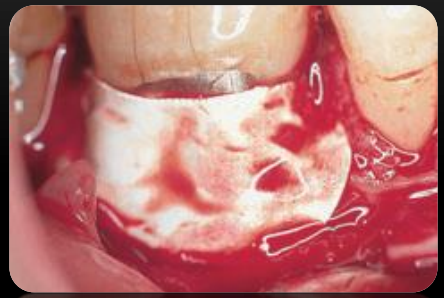






GTR-technique – non resorbable membrane





a buccal degree II furcation-involved mandibular first molar.


removal of the membrane 6 weeks later


1 year later

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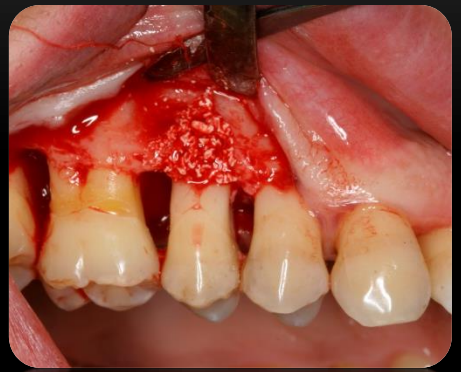
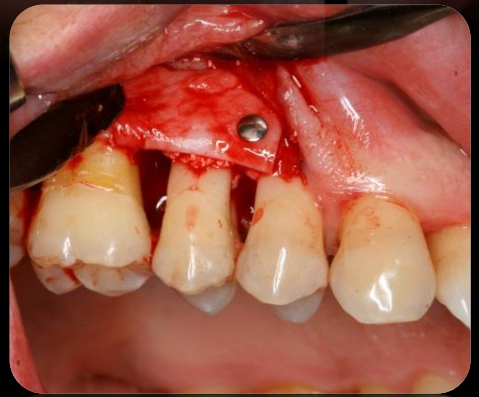
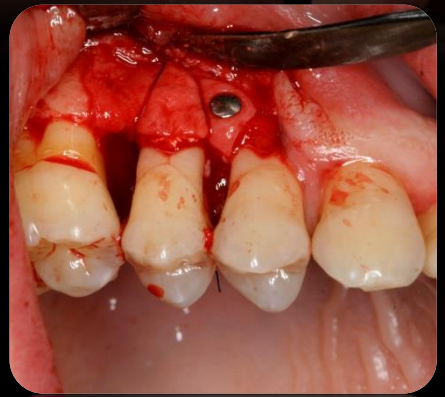
Regeneration - combined therapy I:

GTR-technika + xenograft + EMD

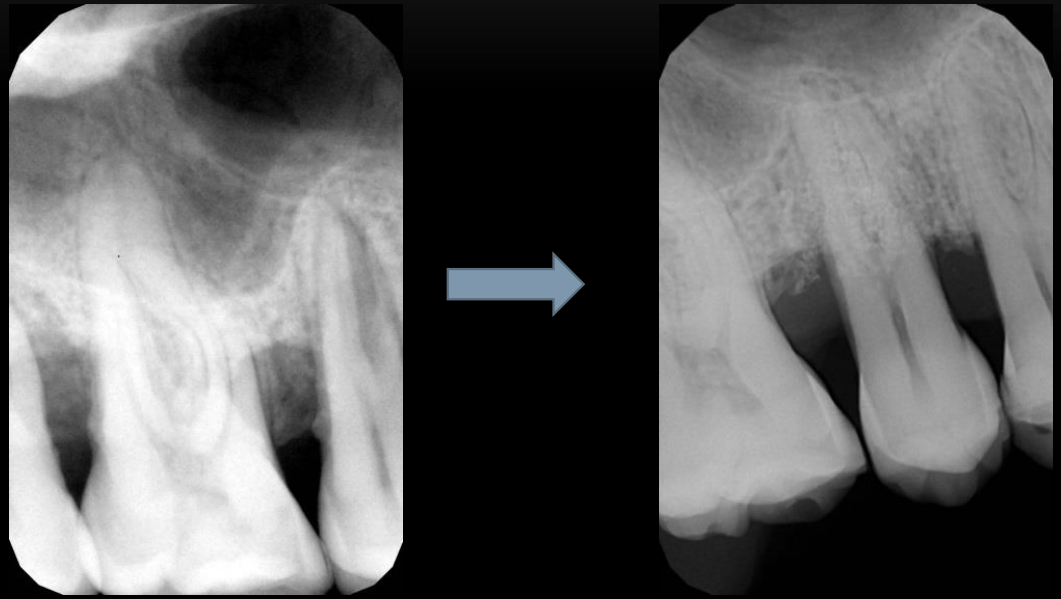



Dr. Nagy Pál

Regeneration - combined therapy I:

GTR-technika + xenograft + EMD



6 months later

Regeneration - combined therapy II:

GTR-technique + xenograft + EMD

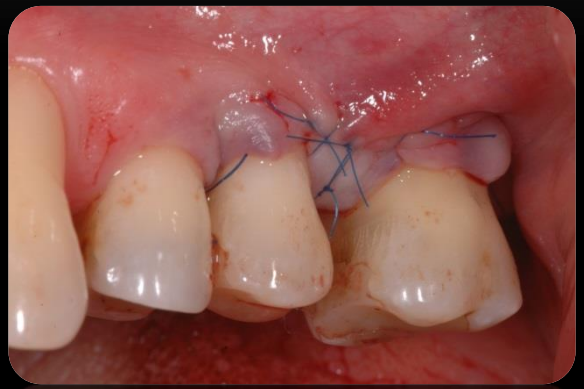
Dr. Chikány Tamás

Application of Bio-oss, Bio-Gide membrane and EMD in the defect





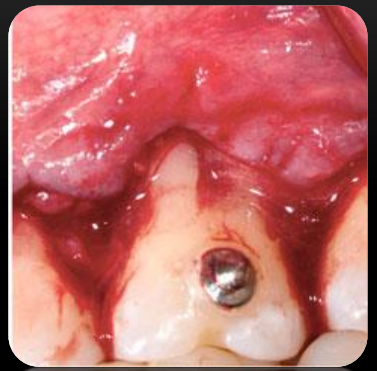

Application of Bio-oss, Bio-Gide membrane and EMD in the defect

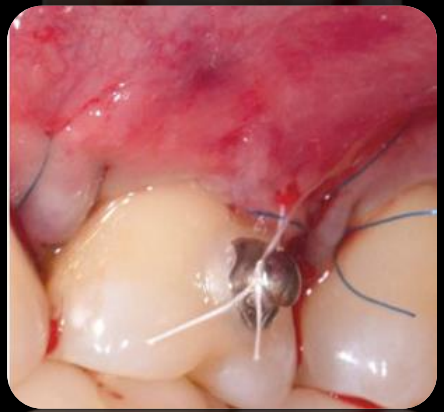


1 year later

Regeneration - combined therapy III:

Xenograft + EMD+ SCTG





Miron RJ, Guillemette V, Zhang Y, Chandad F, Sculean A. Enamel matrix derivative in combination with bone grafts: a review of the literature. Quintessence Int 2014: 45: 475–487.

Regeneration - combined therapy III:

Xenograft + EMD+ SCTG

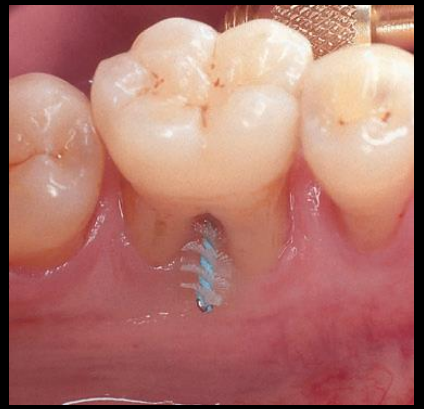
Treatment options of furcation lesions

Class III

- Tunnel preparation
- Root separation (premolarisation = bicuspidation)
- Root resection (RSR) -
- Extraction

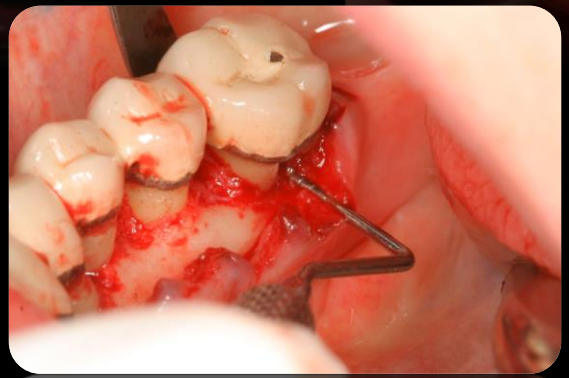
Tunnel preparation

- Used to treat deep degree II and degree III furcation defects
- Includes the surgical exposure and managament of entire furcation area of the affected molar
- Mostly at mandibular molars!!!
- Can be offered at molars which have a **short root trunk, wide separation angle and long divergence between the roots**
- Following the reflection of the flap, the granulation tissue in the defect is removed
- Hard tissue resection (osteoplasty) – to allow access for cleaning devices
- The flaps are apically positioned
- for patient with very good manual skill!!!
- Postoperativ: often root sensitivity => local fluoride varnish (Hamp et al,1975)
- Disadvantage: risk for root caries and root resorption (Feres et al. 2006.)
- Advantage: not needed endodontic treatment



Clinical periodontology and implant dentistry – Fifth edition (2008) – Jan Lindhe, Niklaus P. Lang, Thorkild Karring

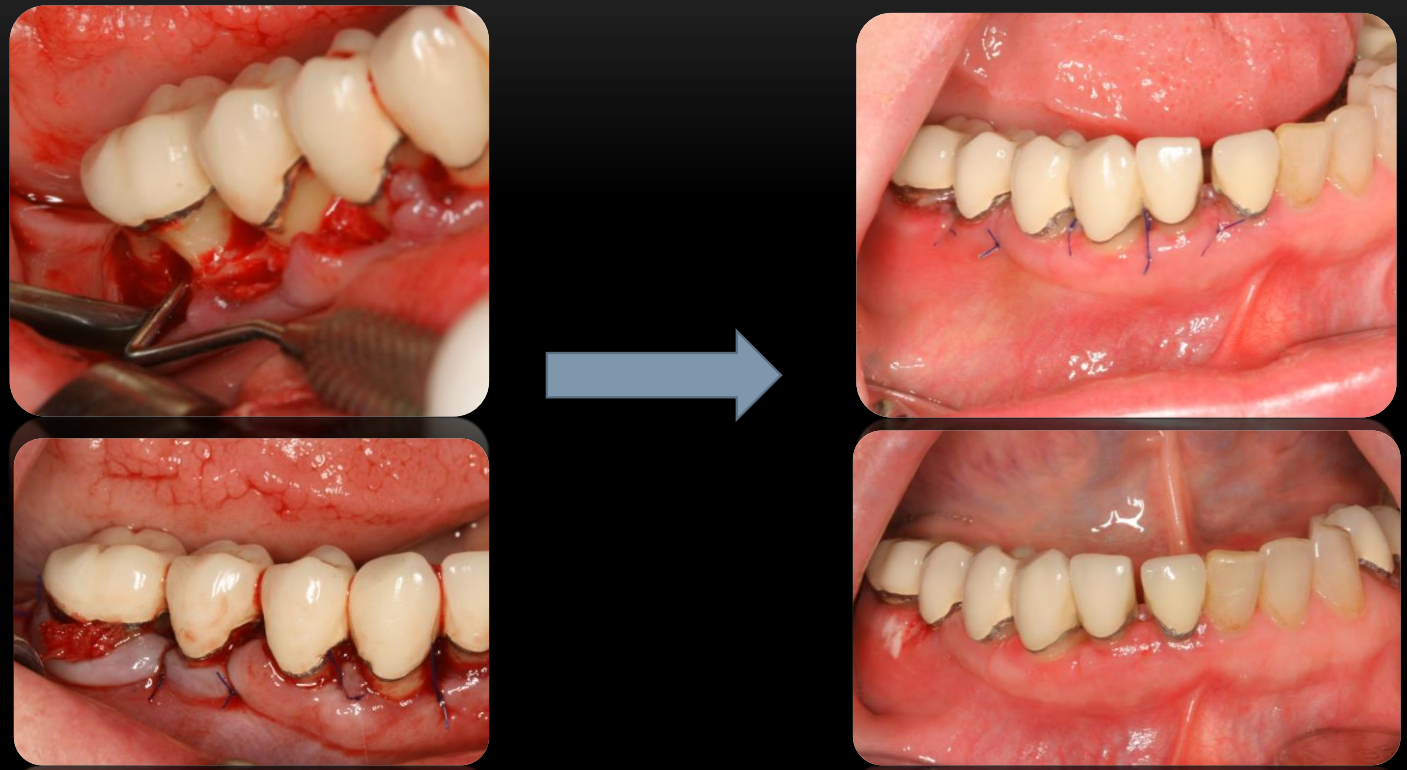
Tunnel preparation



Ramfjord SP, Nissle RR. The modified widman flap. J Periodontol. 1974 Aug;45(8):601-7.

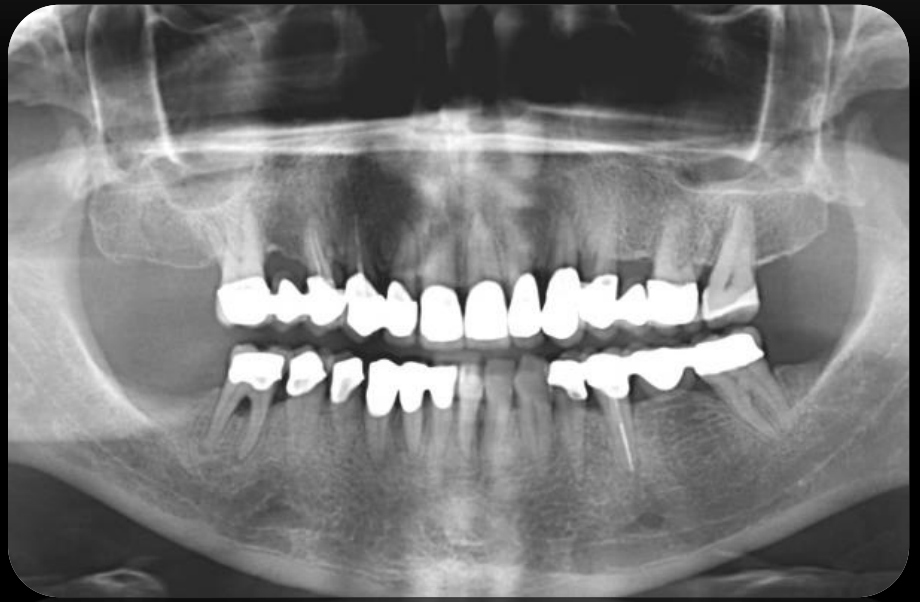
Dr. El-Hage Jade Bence

Tunnel preparation



Hellden LB, Elliot A, Steffensen B, Steffensen JE. The prognosis of tunnel preparations in treatment of class III furcations. A follow-up study. J Periodontol. 1989 Apr;60(4):182-7.

Prosthetic rehabilitation 6 months later



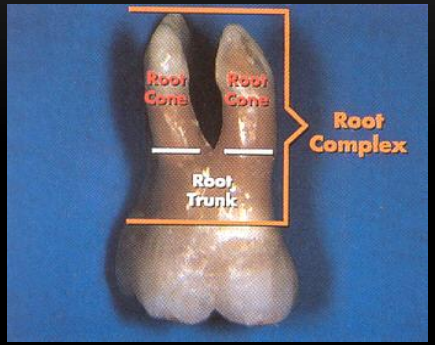
Root separation and resection (RSR) - hemisection

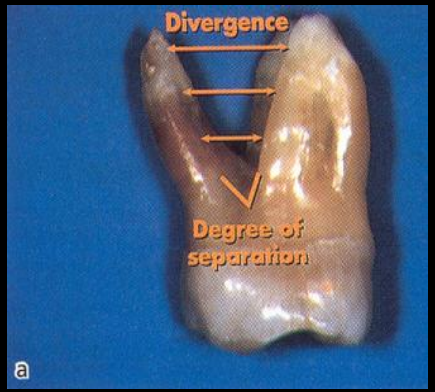
- Radical, if there isn't other option for save of the tooth
- Before the treatment : lege artis root canal treatment
- 2 steps: separation and extraction
- temporary prosthetics solutions with occlusal correction
- 2-3 months observation period – until the end of the early healing
- definitive prosthetic solution 8-12 months later after the treatment

Herbert F. Wolf, Klaus H. Rateitschak, Edith M. Rateitschak: Parodontologie: Farbatlanten der Zahnmedizin

Aspects - anatomy important!

- The lenght of the root trunk (short root trunk may favourable for RSR)
- The divergence between the root cones (small divergence => problem with the separation, orthodontic movement?, odontoplasty)
- The lenght and the shape of the root cones (small,short root => prosthetic solution?)
- Fusion between root cones, pseudofurcation (maxillary praemolars)
- Amount of remaining support around individual roots (long-term prognosis)
- Stability of individual roots (following root separation)
- Access for oral hygiene devices (suitable ?)

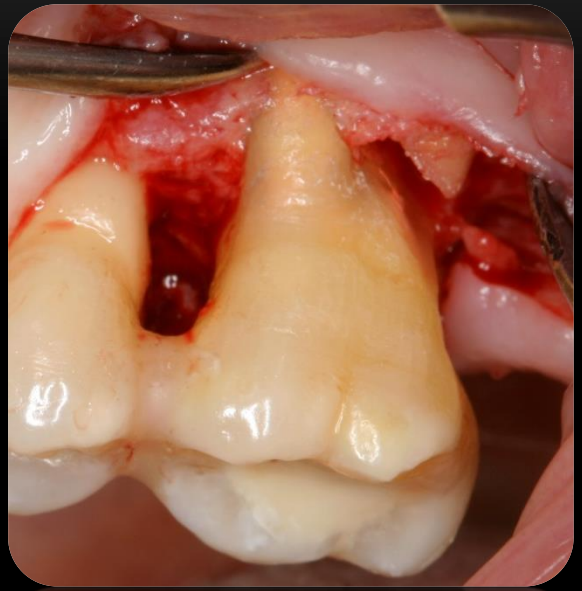


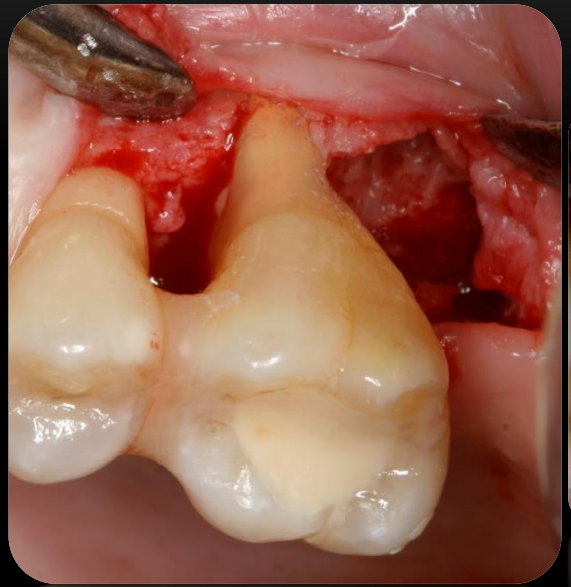


Root resection

Dr. Bányai Miklós

Separation and removal of DB root (#26)





Carnevale G, Pontoriero R, di Febo G. Long-term effects of root-resective therapy in furcation-involved molars. A 10-year longitudinal study. J Clin Periodontol. 1998 Mar;25(3):209-14.

1 year later

CASE

1989

2003

Prof. Dr. Gera István

Premolarisation (bicuspidization)

Premolarisation: combination of tunnelisation and hemisection.none of the roots are removed, both of them take part separately in the prosthetic rehabilitation.If the roots are too close to each other orthodontic treatment can be applied to create space between them. *(Carnevale et al. 1991, 1998)*

Carnevale G, Di Febo G, Tonelli MP, Marin C, Fuzzi M. A retrospective analysis of the periodontal prosthetic treatment of molars with interradicular lesions. Int J Periodontics Restorative Dent. 1991;11(3):189-205.
Carnevale G, Pontoriero R, di Febo G.Long-term effects of root-resective therapy in furcation-involved molars. A 10-year longitudinal study. J Clin Periodontol.1998 Mar;25(3):209-14.

Separation (bicuspidization) and resection

Premolarization at first molar and root resection at second molar

Clinical periodontology and implant dentistry – Fifth edition (2008) – Jan Lindhe, Niklaus P. Lang, Thorkild Karring

Aspects of the prosthetic rehabilitation at the periodontological compromised teeth

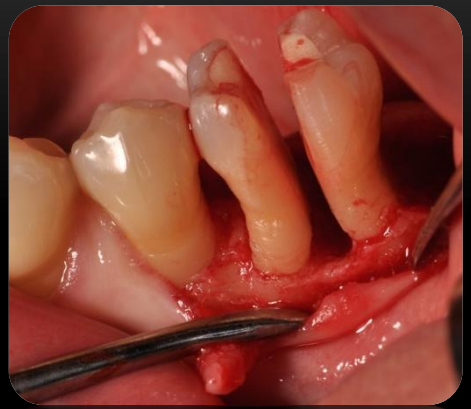
Dissection and premolarization, Prosthetic solution: removable telescopic splint

Hou GL, Tsai CC, Weisgold AS. Treatment of molar furcation involvement using root separation and a crown and sleeve-coping telescopic denture. A longitudinal study. J Periodontol. 1999 Sep;70(9):1098-109.

CASE – premolarisation and final prosthetic restauration of the tooth No. 36

Dr. Bányai Miklós

premolarisation and final prosthetic restauration of the tooth No. 36

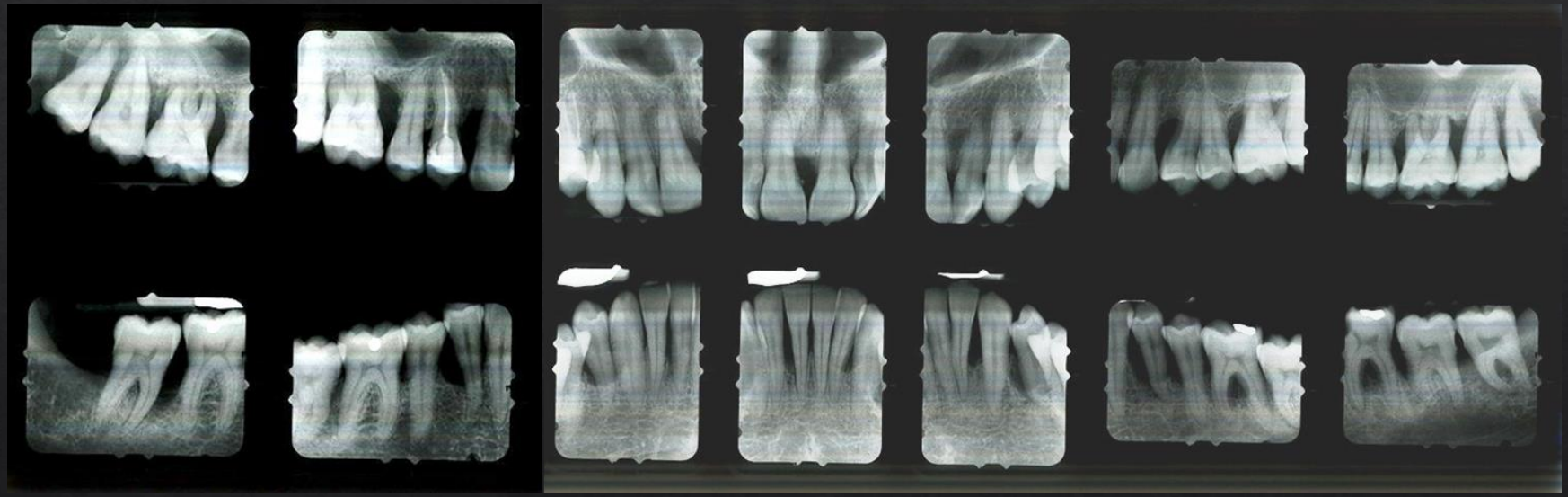






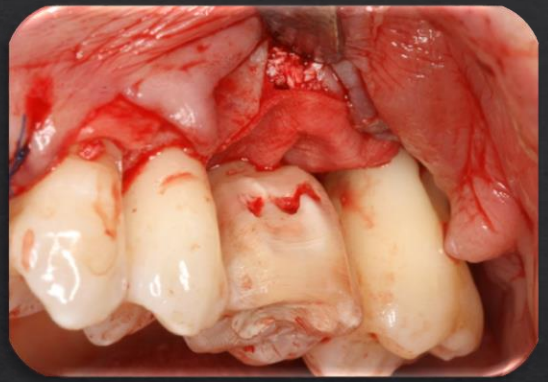
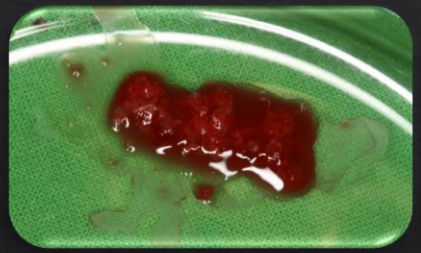
Root resection

CASE: dissection and resection of buccal roots at teeth No. 16,26



Dr. Nagy Pál

Regenerative surgery with GTR-technique at upper left quadrant:
Bio-Gide+ Bio-Oss and autologous bone (and dissection of tooth No. 26)

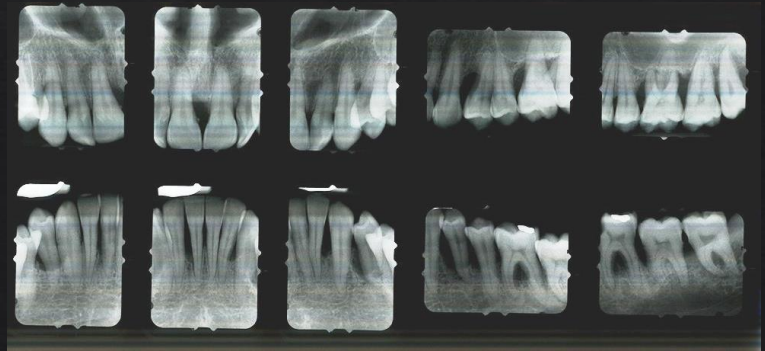
Carnevale G et al.: *Long term effects of root resective therapy in furcation-involved molars. A 10 year longitudinal study.*
J Clin Periodontol 1998; 25:209-214

Sculean A, Stavropoulos A, Windisch P, Keglevich T, Karring T, Gera I.: *Healing of human intrabony defects following regenerative periodontal therapy with bovine derived xenograft and guided tissue regeneration.*
Clin Oral Investig 2004; 8:70-74

Definitive prosthetic rehabilitation

3 years later

Compared to initial x-ray status



Treatment options of furcation involved teeth

Prosthetic rehabilitation of furcation involved teeth

Prosthetic rehabilitation of furcation involved teeth

- keeping in mind furcation entry
- Concavity of the marginal area
- Furcation entry should be cleansable!!!

Prosthetic rehabilitation of furcation involved teeth

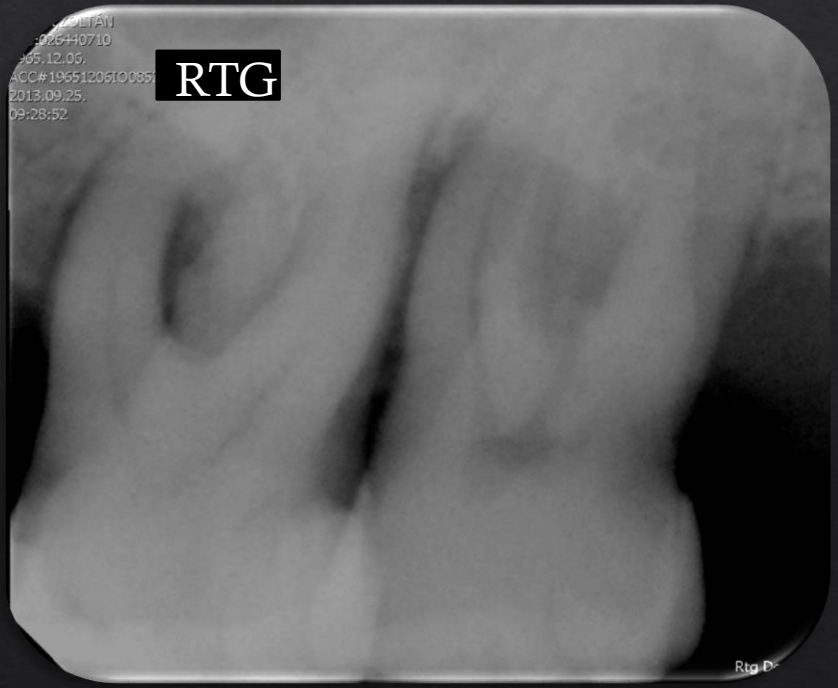
CASE: DB root resection of tooth No. 26

Dr. Nagy Pál

Prosthetic rehabilitation of furcation involved teeth

- Root resection (hemisection)
- Tunnel preparation
- Premolarization (bicuspidisation)

CASE: 26: root resection: DB premolarization: MB and P roots
27: root resection: P, tunnel preparation: MB and DB roots



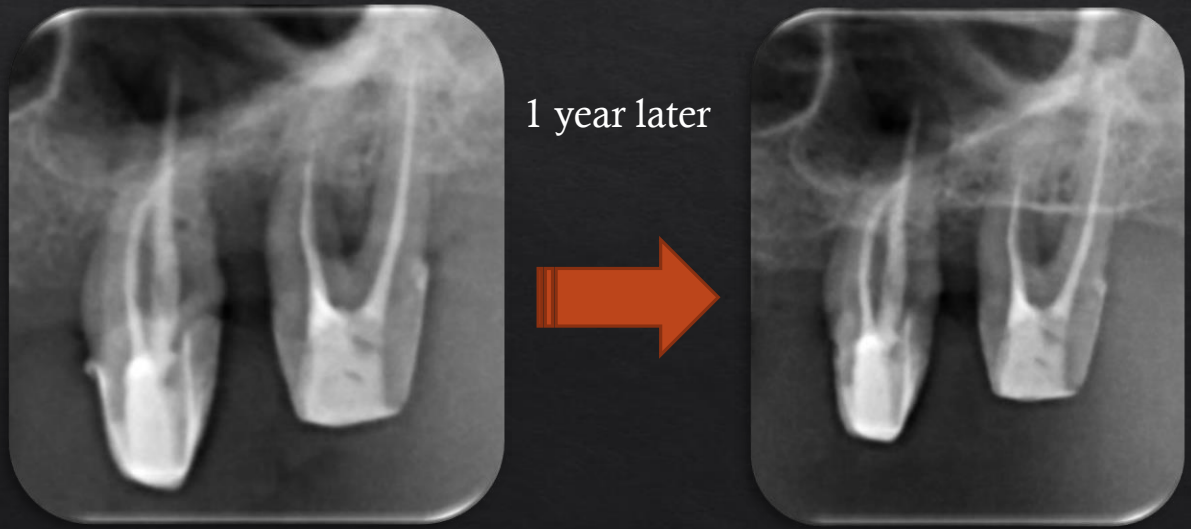
Dr. Nagy Pál

Prosthetic rehabilitation of furcation involved teeth

- Root resection (hemisection)
- Tunnel preparation
- Premolarization(bicuspidisation)

CASE: 26: root resection: DB, premolarization: MB and P roots
27: root resection: P, tunnel preparation: MB and DB roots

RTG



Prosthetic rehabilitation of furcation involved teeth

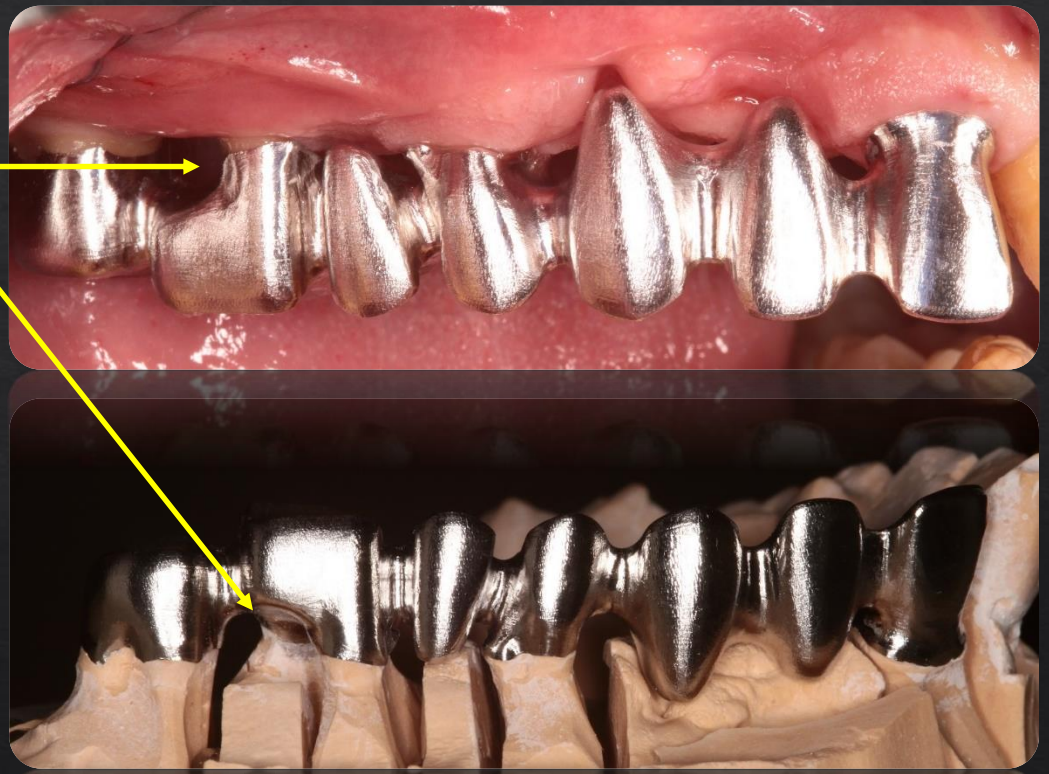
26: DB root resection, premolarization of MB and P roots,
27: P root resektion and tunnelization of MB and DB roots

Prosthetic rehabilitation of furcation involved teeth

26: DB root resection, premolarization of MB and P roots,
27: P root resektion and tunnelization of MB and DB roots

Key factors in the design of the framework in case of dissected/premolarized roots:

- concavity of the framework at the marginal area !
- Margin of the crown should be metal or zirconia
- the connector parts of the framework should be curved and left uncovered (without ceramic)



Prosthetic rehabilitation of furcation involved teeth

26: DB root resection, premolarization of MB and P roots,
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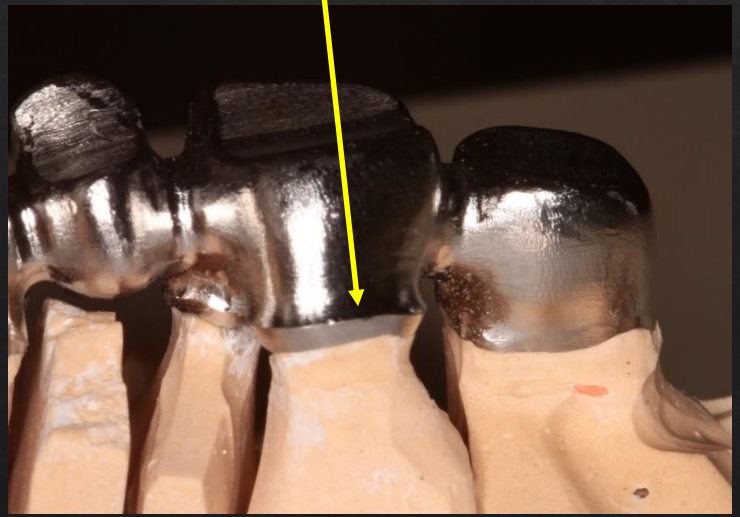

Prosthetic rehabilitation of furcation involved teeth

26: DB root resection, premolarization of MB and P roots,
27: P root resektion and tunnelization of MB and DB roots

Extraction

Thank you for your attention!